CLAIMS

What is being claimed is:

1. A system comprising:

a semiconductor light emitting device capable of emitting first light having a first peak wavelength;

a first fluorescent material layer comprising a first wavelength converting material capable of absorbing the first light and emitting second light having a second peak wavelength longer than the first peak wavelength; and

a second fluorescent material layer comprising a second wavelength converting material capable of emitting third light having a third peak wavelength longer than the second peak wavelength, wherein the second fluorescent material layer is disposed adjacent to the semiconductor light emitting device;

wherein at least one of the first fluorescent material layer and the second fluorescent material layer comprise a second material that is not a wavelength converting material.

2. The system of claim 1 wherein the second fluorescent material layer overlies the semiconductor light emitting device and the first fluorescent material layer overlies the second fluorescent material layer.

3. The system of claim 1 wherein:

the first fluorescent material layer is disposed on a first portion of the semiconductor light emitting device;

the second fluorescent material layer is disposed on a second portion of the semiconductor light emitting device; and

the first portion is adjacent to the second portion.

4. The system of claim 1 wherein:

the first fluorescent material layer is disposed on a first plurality of discrete regions on the semiconductor light emitting device; and

the second fluorescent material layer is disposed on a second plurality of discrete regions on the semiconductor light emitting device.

5. The system of claim 4 wherein the first plurality of discrete regions and the second plurality of discrete regions form a checkerboard pattern.

6. The system of claim 1 wherein:

the second fluorescent material layer is disposed on a plurality of discrete regions on the semiconductor light emitting device; and

the first fluorescent material layer overlies the second fluorescent material layer.

7. The system of claim 1 wherein:

the first peak wavelength is blue;

the second peak wavelength is green; and

the third peak wavelength is red.

8. The system of claim 1 wherein:

the first peak wavelength is blue;

the second peak wavelength is yellow; and

the third peak wavelength is red.

9. The system of claim 1 wherein the first wavelength converting material is selected from the group of $(Lu_{1-x-y-a-b}Y_xGd_y)_3(Al_{1-z}Ga_z)_5O_{12}:Ce_a^{3+}Pr_b^{3+}$ wherein $0 < x < 1$, $0 < y < 1$, $0 < z \leq 0.1$, $0 < a \leq 0.2$ and $0 < b \leq 0.1$, $Lu_3Al_5O_{12}:Ce^{3+}$, $Y_3Al_5O_{12}:Ce^{3+}$, $(Sr_{1-a-b}Ca_bBa_c)Si_xN_yO_z:Eu_a^{2+}$ wherein $a = 0.002 - 0.2$, $b = 0.0 - 0.25$, $c = 0.0 - 0.25$, $x = 1.5 - 2.5$, $y = 1.5 - 2.5$, $z = 1.5 - 2.5$, $SrSi_2N_2O_2:Eu^{2+}$, $(Sr_{1-u-v-x}Mg_uCa_vBa_x)(Ga_{2-y-z}Al_yIn_zS_4):Eu^{2+}$, $SrGa_2S_4:Eu^{2+}$, and $Sr_{1-x}Ba_xSiO_4:Eu^{2+}$.

10. The system of claim 1 wherein the second wavelength converting material is selected from the group of $(Ca_{1-x}Sr_x)S:Eu^{2+}$ wherein $0 < x \leq 1$, $CaS:Eu^{2+}$, $SrS:Eu^{2+}$, $(Sr_{1-x-y}Ba_xCa_y)_{2-z}Si_{5-a}Al_aN_{8-a}O_a:Eu_z^{2+}$ wherein $0 \leq a < 5$, $0 < x \leq 1$, $0 \leq y \leq 1$, and $0 < z \leq 1$, and $Sr_2Si_5N_8:Eu^{2+}$.

11. The system of claim 1 wherein the second material is selected from the group of resin, silicone, and silica.

12. The system of claim 1 wherein the first fluorescent material layer and second fluorescent material layer are arranged to maximize a luminous equivalent of a combination of the first, second, and third light.

13. The system of claim 1 wherein the first fluorescent material layer and second fluorescent material layer are arranged to maximize color rendering index of a combination of the first, second, and third light.

14. The system of claim 1 further comprising a third fluorescent material layer comprising a third wavelength converting material capable of emitting fourth light having a fourth peak wavelength.

15. The system of claim 14 wherein:

the first peak wavelength is UV;

the second peak wavelength is blue;

the third peak wavelength is red; and

the fourth peak wavelength is green.

16. The system of claim 15 wherein:

the second fluorescent material layer is adjacent to the semiconductor light emitting device;

the third fluorescent material layer overlies the second fluorescent material layer; and

the first fluorescent material layer overlies the third fluorescent material layer.

17. The system of claim 1 wherein the first fluorescent material layer comprises an amount of second wavelength converting material.

18. A device comprising:

at least one semiconductor light emitting device capable of emitting first light having a first peak wavelength;

a cover plate spaced apart from the at least one semiconductor light emitting device;

a first fluorescent material layer comprising a first wavelength converting material, the first wavelength converting material capable of absorbing the first light and emitting second light having a second peak wavelength, the second peak wavelength being longer than the first peak wavelength; and

a second fluorescent material layer comprising a second wavelength converting material, the second wavelength converting material capable of emitting third light having a third peak wavelength longer than the second peak wavelength;

wherein the first fluorescent material layer and the second fluorescent material layer are disposed on the cover plate.

19. The device of claim 18 wherein the third light combines with the first light and the second light to form mixed light that appears white.

20. The device of claim 18 wherein the first fluorescent material layer and second fluorescent material layer are arranged to maximize a luminous equivalent of a combination of the first, second, and third light.

21. The device of claim 18 further comprising one or more filters.

22. The device of claim 21 wherein the first fluorescent material layer and second fluorescent material layer are arranged to maximize a gamut of color after the first, second, and third light are filtered by the one or more filters.

23. The device of claim 18 wherein the first wavelength converting material and second wavelength converting material are deposited as discrete layers.

24. The device of claim 23 wherein the second wavelength converting material layer is closer to the at least one semiconductor light emitting device than the first wavelength converting material layer.

25. The device of claim 18 wherein the first wavelength converting material is selected from the group of $(Lu_{1-x-y-a-b}Y_xGd_y)_3(Al_{1-z}Ga_z)_5O_{12}:Ce_a^{3+}Pr_b^{3+}$ wherein $0 < x < 1$, $0 < y < 1$, $0 < z \leq 0.1$, $0 < a \leq 0.2$ and $0 < b \leq 0.1$, $Lu_3Al_5O_{12}:Ce$, $Y_3Al_5O_{12}:Ce^{3+}$, $(Sr_{1-a-b}Ca_bBa_c)Si_xN_yO_z:Eu_a^{2+}$ wherein $a = 0.002 - 0.2$, $b = 0.0 - 0.25$, $c = 0.0 - 0.25$, $x = 1.5 - 2.5$, $y = 1.5 - 2.5$, $z = 1.5 - 2.5$, $SrSi_2N_2O_2:Eu^{2+}$, $(Sr_{1-u-v-x}Mg_uCa_vBa_x)(Ga_{2-y-z}Al_yIn_zS_4):Eu^{2+}$, $SrGa_2S_4:Eu^{2+}$, and $Sr_{1-x}Ba_xSiO_4:Eu^{2+}$.

26. The device of claim 18 wherein the second wavelength converting material is selected from the group of $(Ca_{1-x}Sr_x)S:Eu^{2+}$ wherein $0 < x \leq 1$, $CaS:Eu^{2+}$, $SrS:Eu^{2+}$, $(Sr_{1-x-y}Ba_xCa_y)_{2-z}Si_{5-a}Al_aN_{8-a}O_a:Eu_z^{2+}$ wherein $0 \leq a < 5$, $0 < x \leq 1$, $0 \leq y \leq 1$, and $0 < z \leq 1$, and $Sr_2Si_5N_8:Eu^{2+}$.

27. The device of claim 18 further comprising an LCD.

28. A method comprising:

providing a semiconductor light emitting device capable of emitting first light having a first peak wavelength;

providing in a path of the first light a first wavelength converting material capable of absorbing light of the first peak wavelength and emitting second light having a second peak wavelength longer than the first peak wavelength;

providing in a path of the first light a second wavelength converting material capable of emitting third light having a third peak wavelength longer than the second peak wavelength; and

arranging the first wavelength converting material and the second wavelength converting material to maximize one or more of luminous equivalent, color rendering index, and gamut of a combination of the first, second, and third light.

29. The method of claim 28 wherein at least one of the first wavelength converting material and the second wavelength converting material is adjacent to the semiconductor light emitting device.

30. The method of claim 28 wherein at least one of the first wavelength converting material and the second wavelength converting material is spaced apart from the semiconductor light emitting device.